

Chapter 3

Affected Environment

3.1 DESCRIPTION OF ENVIRONMENTAL RESOURCES

The affected environment descriptions presented in this chapter provide the context for understanding the environmental consequences described in Chapter 4. As such, they serve as a baseline from which any environmental changes that may be brought about by implementation of the proposed action and alternatives can be identified and evaluated. The DOE sites evaluated include Hanford, NTS, INEL, Pantex, ORR, SRS, RFETS, and LANL. All eight DOE sites were evaluated under the No Action Alternative, and the first six were evaluated for long-term storage and disposition alternatives. Six of the DOE sites were evaluated for various disposition alternatives (for example, evolutionary LWR). The generic sites evaluated include a borehole site, a commercial MOX fuel fabrication facility, an existing LWR, and a partially completed LWR. The natural and human resources, as well as the facility-related resources that may be affected by the proposed action, are grouped into the following interest areas for analysis in this PEIS:

- Land resources
- Site infrastructure
- Air quality and noise
- Water resources
- Geology and soils
- Biological resources
- Cultural and paleontological resources
- Socioeconomics
- Public and occupational health and safety
- Waste management

In addition, the existing conditions and potential environmental impacts of intersite transportation of materials and environmental justice associated with the proposed action are described in Sections 4.4 and 4.5, respectively.

The alternatives defined in Chapter 2 are associated with the long-term storage of weapons-usable fissile materials and disposition of surplus Pu. In addition to these proposed actions, the No Action Alternative has also been assessed.

3.1.1 LAND RESOURCES

Definition of Resources

Land resources comprise all of the terrestrial areas available for economic production, residential or recreational use, governmental activities (for example, energy research facilities), or for natural resource protection. Primary concerns would be caused by changes in land use; conflicts with the objectives of applicable land-use plans, policies, and controls; and the degree of contrast between proposed development and the existing visual landscape. Potential effects to special status lands (for example, prime farmland, wilderness study area, or Wild and Scenic River), if any, are highlighted. The use or development of land resources is subject to regulation and must conform to governmental plans, policies, and controls at Federal, State, and local (regional, county, and municipal) levels.

Land Use. Land may be characterized by its potential for the location of human activities (land use). Natural resource attributes and other environmental characteristics could make a site more suitable for some land uses than for others. Changes in land use may have both beneficial and adverse effects on other resources (biological, geological, cultural, water, and air).

Visual Resources. Visual resources are natural and human-created features that give a particular landscape its character and aesthetic quality. Landscape character is determined by the visual elements of form, line, color, and texture. All four elements are present in every landscape; however, they exert varying degrees of influence. The stronger the influence exerted by these elements in a landscape, the more interesting the landscape. The more visual variety that exists with harmony, the more aesthetically pleasing the landscape.

Approach to Defining Environmental Setting

Land Use. The environmental setting for land resources was defined by first delineating the region of influence (ROI) and then gathering information on land-use patterns and densities pertaining to that area. The land-use ROI for alternatives to be constructed at current DOE installations includes lands within 3.22 km (2 mi) of the DOE sites. Land use associated with alternatives for which site-specific locations have not been identified are described generically, based on existing information about typical locations. Land-use data were obtained from data input reports; reviews of related environmental documents; information supplied by appropriate Federal, State, or local governmental agencies; maps; and photographs.

Visual Resources. Visual resource assessments were based on the Bureau of Land Management (BLM) VRM methodology. Management classes describe the different degrees of modification allowed to the basic elements of the landscape and are used to assess the visual effect of proposed development. Class designations are derived from an inventory of scenic quality, sensitivity levels, and distance zones of a particular area. The elements of scenic quality are landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modification. Scenic value is determined by variety and harmonious composition of the elements of scenic quality. Sensitivity levels are determined by user volumes and user attention. Distance zones concern the relative visibility from travel routes or observation points. Distance zones include the following categories: foreground, 0.0 to 0.8 km (0 to 0.5 mi); middleground, 0.8 to 4.8 km (0.5 to 3 mi); background, 4.8 to 8 km (3 to 5 mi); and seldom seen, 8 km (5 mi) to infinity and areas blocked or screened from view. To determine how the visual resources of the site could be affected, the contrast of proposed development to the existing visual landscape (that is, visual resource inventory) and the sensitivity of viewpoints is analyzed.

The existing landscape at each analyzed site is assigned a VRM classification ranging from 1 to 5. Class 1 would apply to pristine areas, including designated wilderness areas and Wild and Scenic Rivers. Class 2 would apply to areas with very limited land development activity, resulting in contrasts that are seen but do not attract attention. Class 3 would apply to areas where contrasts caused by development activity are evident, but the natural landscape still dominates. Class 4 would apply to areas where contrasts caused by human activities

attract attention and are dominant features of the landscape in terms of scale, but repeat the form, line, color, and texture of the characteristic landscape. Class 5 would apply to areas where contrasts caused by human activities are the dominant feature of the landscape to the point that the natural landscape character no longer exists. For alternatives involving new facilities at non-DOE sites, a generic environmental baseline was developed based on existing resource data from representative sites.

3.1.2 SITE INFRASTRUCTURE

Definition of Resources

Site infrastructure includes those utilities and other resources required to support construction and continued operation of mission-related facilities identified under the various alternative actions. The resources described and analyzed in this PEIS include electrical power and electrical load capacity requirements; natural gas, coal, and oil fuel requirements; and transportation networks, including roads and rail access.

Approach to Defining Environmental Setting

For existing DOE sites that may be selected or analyzed for actions under the proposed alternatives, projections of electricity availability, site development plans, and other DOE mid- and long-range planning documents were utilized to describe existing site infrastructure conditions. The ROI for existing DOE sites has been limited to the boundaries of those sites.

Under some of the PEIS alternatives, specific candidate sites are not identified. As a result, no planning documents are available to provide descriptions of the site infrastructure or to establish a detailed baseline from which environmental consequences can be estimated. For these cases, generic environmental baselines based on existing information about typical locations were developed in order to define conditions. For alternatives involving new facilities at non-DOE sites, the ROI is large enough to encompass the non-DOE site and the infrastructure construction to support the new facilities.

3.1.3 AIR QUALITY AND NOISE

Definition of Resources

Air Quality. Air pollution refers to any substance in the air that could harm human or animal populations, vegetation, or structures, or that unreasonably interferes with the comfortable enjoyment of life and property. For the purpose of this document, only outdoor air pollutants are addressed. Pollutants may include almost any natural or artificial compound capable of being airborne. They may be in the form of solid particles, liquid droplets, gases, or in combinations of these forms. Generally, they can be categorized as primary pollutants (those emitted directly from identifiable sources) and secondary pollutants (those produced in the air by interaction between two or more primary pollutants, or by reaction with normal atmospheric constituents, with or without photoactivation). Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Air quality is affected by air pollutant emission characteristics, meteorology, and topography.

Ambient air quality in a given location has been described as the concentration of various pollutants in the atmosphere compared to the corresponding standards. Ambient air quality standards have been established by Federal and State agencies, allowing an adequate margin of safety for protection of public health and welfare from adverse effects associated with pollutants in the ambient air. Pollutant concentrations higher than the corresponding standards are considered unhealthy. Concentrations below the corresponding standards are considered acceptable.

The pollutants of concern are primarily those for which Federal and State ambient air quality standards have been established, including criteria pollutants, hazardous air pollutants, and other toxic air compounds. The criteria pollutants are those defined in 40 Code of Federal Regulations (CFR) 50, *National Primary and Secondary Ambient Air Quality Standards*. The hazardous air pollutants and other toxic compounds are listed in Title III of the 1990 *Clean Air Act* (CAA) as amended through May 1992, those regulated by the National Emissions Standards for Hazardous Air Pollutants (NESHAP), and those that have been proposed or adopted in regulations or are listed in guidelines by the respective States.

Noise. Sound results from the compression and expansion of air or some other medium when an impulse is transmitted through it. Sound requires a source of energy and a medium for transmitting the sound wave. The propagation of sound is affected by various factors, including meteorology, topography, and barriers. Noise is unwanted sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities or diminish the quality of the environment.

Sound level measurements recorded to determine effects on humans are compensated by an A-weighted scale that accounts for the hearing response characteristics of the human ear. Sound levels are expressed in decibels (dB), or in the case of A-weighted measurement, decibels A-weighted (dBA). EPA has developed guidelines for noise levels for different land-use classifications. Some States and localities have established noise control regulations or zoning ordinances that specify acceptable noise levels by land-use category. These regulations are discussed in Appendix F for each site.

Approach to Defining Environmental Setting

Air Quality. The ROI for air quality would encompass the area surrounding the candidate site that is potentially affected by air emissions caused by the storage and disposition alternatives. Generally, the air quality impact area would cover a few kilometers downwind from the source. The area of the ROI depends on emission source characteristics, pollutant types, emission rates, and meteorological and topographical conditions. For the purpose of identifying the maximum air quality impacts from the proposed alternatives, an area within 10 km (6 mi) of the emission source has been selected as the impact area to be used in the air quality modeling analysis.

Meteorological and climatological data for each candidate site are obtained from the most recent site-specific environmental reports or *Local Climatological Data, Annual Summaries* produced by the National Oceanic and Atmospheric Administration (NOAA). One year of sequential hourly representative National Weather Service data from National Climatic Data Center or onsite meteorological data from the candidate site were obtained for air modeling analyses.

Areas with air quality better than the National Ambient Air Quality Standards (NAAQS) are designated as being in attainment; areas with air quality worse than the NAAQS are classified as nonattainment areas. Areas may be designated as unclassified when there is a lack of data to form a basis for an attainment status designation. The United States is divided into attainment, nonattainment, and unclassified areas by county, metropolitan statistical area, consolidated metropolitan statistical area, or portions thereof. Air Quality Control Regions (AQCR) designated by EPA are listed in 40 CFR 81, *Designation of Areas for Air Quality Planning Purposes*.

For locations that are in an attainment area, Prevention of Significant Deterioration (PSD) regulations limit pollutant emissions from new sources and establish allowable increments of pollutant levels. Three PSD classifications are designated based on criteria established in the CAA amendments. Class I areas include national wilderness areas, memorial parks larger than 20.2 square kilometers (km^2) (7.8 square miles [mi^2]), and national parks larger than 24.3 km^2 (9.4 mi^2). Class II areas include all areas not designated as Class I. Class III areas, which would allow greater deterioration than Class II areas, have not been designated.

Designation as a nonattainment area triggers control requirements designed to achieve attainment status by specified dates. In addition, facilities that constitute major new emission sources cannot be constructed in a nonattainment area without permits that impose stringent pollution control requirements to ensure progress toward compliance.

Baseline air quality of the affected environment is based on model predicted pollutant concentrations for existing sources at each site using concentrations presented in existing source documents or by modeling recent emissions data. Emissions data for existing sources are based on permit applications, the most recent site-specific environmental reports, or emission inventories.

For the generic environments used to establish a context for comparison of relative impacts from Pu disposition technologies, the assessment of potential air impacts resulting from the implementation of these technology options is not directed to specific locations, but instead to a generic site in the continental United States. For a generic site, no site-specific air pollutant emissions data can be determined. Generic site information pertaining to air quality is described with respect to air quality within the continental United States. Site-specific air quality analyses of applicable disposition alternatives would be addressed in tiered NEPA documentation, as appropriate.

Toxic air pollutants are addressed in both the air quality and noise section and the public and occupational health section for each of the candidate sites. In the air quality section, the maximum concentration of toxic air pollutants at or beyond the site boundary is compared with a Federal, State, or local standard to determine compliance. In the Public and Occupational Health section, a health risk is calculated based upon chemical concentration and toxicity compared to the Reference Concentration (RfC) for the public and the Permissible Exposure Level (PEL) for workers for noncancer causing chemicals and slope factors for the public and workers for cancer causing chemicals. The cancer effects are a risk that is based on the slope factor (cancer potency) for chemicals that are regulated as carcinogens.

These differences in analytical methods result in the different pollutants analyzed between the air quality analysis and the public and occupational health analysis. In the air quality analysis, toxic pollutants with low emission rates in most cases will result in extremely low concentrations at the site boundary and therefore are not presented in the air quality analysis. In the public and occupational health analysis, many of the same chemical pollutants may expose an onsite worker located 100 m (328 ft) from the emission source to a health risk, and therefore are presented in this analysis. The hazardous chemical pollutants used by these two

disciplines to evaluate impacts will be different. Compliance to standards does not consider what health effects are expected nor the interaction between several chemicals that may together cause adverse health responses even if they separately are at below standard concentrations.

Noise. Noise from facility operations and traffic has the potential to affect local human and animal populations. Because most nontraffic noise associated with construction and operation of the proposed facilities is located at sufficient distance from offsite noise-sensitive receptors, the contribution to offsite noise levels is expected to be small. Impacts associated with access routes, including noise from increased traffic, are not analyzed in this document because information that would be needed for such an assessment has not been developed at this programmatic level of analysis. No acoustics-related impacts are anticipated to affect DOE's decision on the proposed facilities. The level of detail describing both the onsite and offsite acoustical environment is presented accordingly.

To provide a context for comparison of these potential acoustical impacts, the existing acoustical environment has been briefly described in terms of existing noise sources, sound level measurements that are available for the ROI, and the range of sound levels that is typical of the land uses in the ROI. The ROI for each of the alternatives includes its site and surrounding areas where related activities might increase noise levels, including transportation corridors in which noise levels could be affected by proposed activities.

In recent years, several DOE sites have compiled sound-level data representative of adjacent areas and transportation routes that serve the site. Where these data are available, they are presented. The *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA-550/9-74-004, March 1974) has identified ranges of sound levels that are typical of various land uses. These ranges of sound levels have been presented for each DOE site. For generic sites, a broad range of sound levels has been identified based on typical land uses adjacent to these types of sites.

3.1.4 WATER RESOURCES

Definition of Resources

Surface Water. Surface water includes marine or freshwater bodies that occur above the ground surface, including rivers, streams, lakes, ponds, rainwater catchments, embayments, and oceans. Surface water quality is characterized by the concentration of inorganic, organic, and biological constituents in surface waters. Surface water bodies are classified based on designated uses that are to be protected (for example, drinking water supply, contact recreation, or cold water fish habitat). Federal, State, and local regulations set standards and criteria that apply to the different classifications. Potable water sources (both surface and groundwater) are regulated by the *Safe Drinking Water Act* (SDWA), while the *Clean Water Act* (CWA) protects the overall quality of the Nation's surface waters. These regulations are summarized in Appendix J.

Groundwater. Groundwater resources are defined as the aquifers underlying the site and their extensions down the hydraulic gradients to, and including, discharge points and the first major users. Groundwater quality, like that of surface water, is characterized by the concentration of its inorganic, organic, and biological constituents. Geology, soils, and the quality of surface water and other sources of aquifer recharge are the main factors affecting groundwater quality.

The quantity of groundwater an aquifer yields is directly related to its geologic properties. In general, the higher the porosity (a measure of void space) and permeability (the interconnectedness of the void space), the greater the aquifer yield. The recharge rate is the rate at which groundwater accumulates in the aquifer and represents the rate at which groundwater can be withdrawn from the aquifer without a net reduction in the quantity of groundwater in storage. Groundwater resources are specifically protected by Federal law under SDWA by the Sole Source Aquifer and Wellhead Protection programs. State and local regulations may provide additional protections, classifications, standards, or criteria.

Approach to Defining Environmental Setting

Surface Water. Surface and groundwater affected by or used in conjunction with site activities define the affected environment in terms of water resources. Surface water resource elements include surface water bodies, flow characteristics, stream classifications, and floodplains.

In support of surface water impact assessment, data obtained from documents (U.S. Geological Survey [USGS] and other Federal Government technical reports and State and local reports and databases) are used to describe major surface water features and to establish current or baseline surface water conditions at the sites. Current surface water usage includes use of surface water or offsite sources (municipal water). The existing water supply was evaluated to determine quantities of available water, capacity of the supplier, and existing water rights, agreements, or allocations. Major stream flows and stream classifications are identified when they are used as a water source or receive effluent discharge from the site. In cases where low flow data are unavailable, average flow data are used.

The water quality of potentially affected receiving waters are determined by reviewing current monitoring data primarily for radiological and nonradiological parameters. Significant known surface water contamination at the site is described. Where applicable, the site NPDES permits are briefly described and the status of compliance with permit limits and requirements is summarized.

One hundred-year floodplains and flooding history of the site, when applicable, are identified at the sites to determine whether areas of the site might be affected by high waters. When possible, the 500-year floodplain is also identified. Specific facility locations will be addressed in tiered environmental analyses, as required.

To define a reasonable generic surface water quality affected environment for alternatives that are not site-specific, a range of existing surface water quality conditions has been presented using water resources data from USGS.

Although baseline surface water quality may be defined by a multitude of parameters, for the purposes of this PEIS the baseline will be defined by those constituents expected to be released or affected by the disposition alternatives. Baseline conditions for parameters such as those regulated under SDWA will provide a basis for evaluating impacts of these alternatives.

Water usage and availability at a generic site are characterized by precipitation. In areas where rainfall is abundant and population is dense, water supply is commonly obtained from local surface water reservoirs and shallow wells. In arid climates, water supply is commonly obtained from deep wells and manmade lakes created by damming major rivers. In humid climates, water supply is generally derived from surface water taken from major waterways. Local constraints include seasonal fluctuations in precipitation, consumption by other facilities using the same water supply, and State regulations, such as the water appropriation permit requirements.

Groundwater. For site-specific analyses, the affected environment discussion includes a description of the potentially affected groundwater basins. The aquifers underlying the site, their extension down the hydraulic gradient to, and including, discharge points, and the first major users are described. The local aquifers are described in terms of the extent, thickness, character of rock formations, recharge and discharge areas, and quality of the groundwater. Aquifers are classified by Federal and State authorities according to use and quality. The Federal classifications include Class I, II, and III groundwater. Class I groundwater is either the sole source of drinking water or is ecologically vital. Class IIA and IIB are current or potential sources of drinking water (or other beneficial use), respectively. Class III is not considered a potential source of drinking water and is of limited beneficial use. Sole source aquifers are identified when located near a DOE site. When applicable, current groundwater usage at the site is identified. Any allocations, existing water rights, or agreements are briefly described.

Available data on existing groundwater quality conditions are compared to Federal and State groundwater quality standards, effluent limitations, and safe drinking water standards. When applicable, known contaminated groundwater areas at the site are described.

Generic descriptions of groundwater availability are developed based on general water supply characteristics. Overdraft of groundwater occurs when water is withdrawn from sources that cannot be renewed or is withdrawn more quickly than it can be recharged. Several areas of the country are experiencing critical groundwater overdraft more than 1,900 million l/day (500 million gal/day) of overdraft, and have low surface water availability relative to demand (VDL 1990a:725).

Many other areas of the country are experiencing moderate overdrafts of 80 to 1,900 million l/day (21.2 to 500 million gal/day) with moderate-to-low levels of surface water availability relative to demand. Other areas experience no overdraft of groundwater supplies or have an adequate supply of surface water relative to demand. The settlement of inter- and intrastate water rights issues that are ongoing or may occur could cause the potential water availability for an area to change and are discussed as applicable.

3.1.5 GEOLOGY AND SOILS

Definition of Resources

Geology resources are consolidated or unconsolidated earth materials, including mineral assets, such as ore and aggregate materials, fossil fuels, and significant landforms. Soil resources are the loose surface materials of the earth in which plants grow, usually consisting of disintegrated rock, organic matter, and soluble salts.

Approach to Defining Environmental Setting

The ROI for geology and soil resources comprises all areas subject to physical disturbance by construction and operational activities associated with an alternative. The exact location of each alternative is not known at this time. Therefore, the ROI may vary from either the area disturbed, for those sites already identified, to the entire site, for those alternatives whose location is unspecified. For alternatives not linked to specific candidate sites, a generic description encompassing a range of likely geologic and soil settings was developed.

The occurrence of geology and soil resources, as well as their status and viability at the various sites proposed, can vary greatly. The geology and soil resources were considered both with respect to the identification of those portions of the resource that could be affected by the alternative and the presence of natural conditions that may affect the alternative. Geology and soil conditions that may affect the integrity and safety of the proposed alternatives are a primary consideration. Specific geologic considerations include seismic activity (vibratory ground motion), volcanism, unique geologic resources, and karst terrain. Specific soil considerations include suitability of soil for construction, soil quality, and erosion.

The physiographic province and geologic setting have been provided for specific sites. For those alternatives that are not site-specific, a range of conditions has been provided. Earthquake potential was evaluated based on the frequency, magnitude, and intensity of past events; the location and distribution of epicenters; and the location of capable faults as defined in 10 CFR 100, Appendix A. The potential for volcanic activities was similarly evaluated. Areas of past mass movements (landslides and other forms of material transport) and conditions favorable for future mass movement were identified, including karst terrains, landslide-susceptible rock and soil materials, and excessive slopes.

Information on the geology and soil resources was derived from the most recent and applicable reports, aerial photographs, and other literature (for example, environmental assessments [EAs], EISs, and facility plans). For those alternatives where the site location has not been identified, information may have been obtained through the following additional sources: DOE; BLM; Bureau of Reclamation, Mineral Management Service; EPA; USGS; and the Soil Conservation Service.

3.1.6 BIOLOGICAL RESOURCES

Definition of Resources

Biological resources are defined as terrestrial and aquatic ecosystems characterized by the presence of native and naturalized flora and fauna. For the purposes of this PEIS, biological resources include terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. Although wetlands and threatened and endangered species could be considered as either terrestrial or aquatic resources, they have been identified for separate analysis in this PEIS because of their special regulatory status.

Terrestrial Resources. Terrestrial resources are defined as those plant and animal species and communities that are most closely associated with the land. For the purposes of this PEIS, terrestrial resources include the major plant communities present in a site or region and the vegetation, amphibians, reptiles, birds, and mammals found within them. Scientific names of non-special status species (both terrestrial and aquatic) listed in the text are provided in Appendix K.

Wetlands. Wetlands are defined by the U.S. Army Corps of Engineers (COE) and EPA as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 CFR 328.3). Thus, wetlands are delineated based upon the occurrence of characteristic vegetation, soils, and hydrology (USCOE 1987a:13-14).

Aquatic Resources. Aquatic resources are defined as those plant and animal species and communities that are most closely associated with a water environment. For the purposes of this PEIS, aquatic resources include the major habitats present in a site or region and the fish species found within them.

Threatened and Endangered Species. Endangered species are defined under the *Endangered Species Act* (ESA) of 1973 (see Appendix J) as those in danger of extinction throughout all or a large portion of their range. Threatened species are defined as those species likely to become endangered within the foreseeable future. The U.S. Fish and Wildlife Service (USFWS) may designate areas of critical habitat for threatened and endangered species. Critical habitat is defined as specific areas that contain physical and biological features essential to the conservation of species and that may require special management considerations or protection. Species that are Federal proposed or candidates for listing as threatened or endangered species do not receive legal protection under ESA. However, the USFWS recommends that impacts to these species be considered in project planning since their status can be changed to threatened or endangered in the foreseeable future. The USFWS has recently changed the classification of species under review for listing as threatened or endangered (61 FR 7596). Proposed species include those plants and animals for which a proposed rule to list as threatened or endangered has been published. Candidate species include those plants and animals for which the USFWS has on file sufficient information on biological vulnerability and threat to support issuance of a proposed rule for listing as endangered or threatened. Candidate species previously included Category 1 (species appropriate for listing as protected) and Category 2 (species possibly appropriate for listing as protected). Due to the recent rule change, candidate species include only those which are appropriate for listing as protected species (i.e., species formerly listed as Category 1). The Category 2 designation has been omitted. Some of the species previously identified as Federal candidate Category 2 in the Storage and Disposition Draft PEIS also have a State status and continue to be evaluated for potential impacts. However, due to the change in candidate classification described above, many species have been eliminated from proposed site threatened and endangered species lists. At the State level, protected species are classified into a variety of categories, including endangered, threatened, sensitive, protected, in need of management, of concern, monitored, or species of special concern.

Approach to Defining Environmental Setting

Since some alternatives presented in this PEIS are site-specific and others are not, the existing environment is discussed at two levels. Where alternatives are associated with specific sites, such as for the storage alternatives, or an assumed location on a DOE site for a number of disposition facilities, the existing environment of those actual sites is addressed. However, these sites are only described when previously undisturbed areas would be affected. Biological resources addressed include terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. Where site locations have not been selected, a more generic discussion is presented. This discussion addresses selected biological resources, including natural habitats (both terrestrial and aquatic), wetlands, threatened and endangered species, and migratory birds. The ROI for site-specific alternatives includes the entire DOE site under consideration, while for non-site-specific alternatives it includes conditions representing various regions of the United States within which the alternative could be located. Data sources used include site-specific studies, as well as regional summaries, as appropriate. Specific data sources include DOE site studies, National Wetland Inventory (NWI) Maps, and USFWS and Natural Heritage Program records on threatened and endangered species.

3.1.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

Definition of Resources

Cultural resources are human imprints on the landscape and are defined and protected by a series of Federal laws, regulations, and guidelines. For this PEIS, cultural resources are separated into prehistoric, historic, and Native American resources. Paleontological resources, although not governed by the same laws on historic preservation, represent a similar type of surface or buried resource that may be affected in the same way as cultural resources. Paleontological resources also will be considered in this section.

Prehistoric Resources. Prehistoric resources are physical properties that remain from human activities that predate written records. These resources generally are identified as either isolated artifacts, sites, or districts. Isolated artifacts may include stone or bone tools, or remains of ceramic pottery. Sites may contain concentrations of artifacts (for example, stone tools and ceramic sherds), features (for example, remains of campfires, residences, or food storage pits), and plant and animal remains. All of these resources can be used to reconstruct life in a region or at a limited location. Depending on their age, complexity, integrity, and relationship to one another, sites may be important for, and capable of, yielding otherwise inaccessible information about past populations.

Historic Resources. Historic resources consist of physical properties that postdate the existence of written records. In the United States, historic resources are generally considered to be those that date no earlier than 1492. Historic resources include architectural structures or districts (for example, religious, commercial, or residential structures, dams, and bridges), archaeological objects, and archaeological features (for example, foundations of mills or residences, trails, and trash dumps). Ordinarily, sites less than 50 years old are not considered historic for analytical purposes, but exceptions can be made for younger properties if they are of exceptional importance, such as structures associated with Cold War themes (36 CFR 60.4).

Native American Resources. Native American resources are sites, areas, and materials important to Native Americans for religious or heritage reasons. In addition, cultural values are placed on natural resources such as plants, which have multiple purposes within various Native American groups. Of primary concern are concepts of sacred space that create the potential for land-use conflicts. Native American resources can include geological or geographic elements such as mountains or creeks; certain species of plants and animals; cemeteries, battlefields, trails, and pueblos; and archaeological sites.

Paleontological Resources. Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geological age. They include casts, molds, and trace fossils such as burrows or tracks. Fossil localities typically include surface outcrops, areas where subsurface deposits are exposed by ground disturbance, and environments that favor preservation, such as caves, peat bogs, and tar pits. These resources are important because they provide scientific information on paleoenvironments and the evolutionary history of plants and animals.

Approach to Defining Environmental Setting

The ROI for cultural and paleontological resources is bounded in three ways. First, there is the general natural setting. This is the location of the resource within a specific geological and geographical region, which can include significant bodies of water such as rivers or lakes; topography, such as slopes, plains, or mountains; and plants and animals that once inhabited or still inhabit the region. Because this natural region affects the location of a given prehistoric or historic resource and the life of its inhabitants, information regarding it is important for describing cultural or paleontological resources. Second, there are the modern political boundaries of the site. This PEIS includes data based on surveys of cultural and paleontological resources that may include an entire site or may include a portion of a specific site. Finally, and most specifically, there is the area directly affected or disturbed by a proposed alternative during construction or operation, including visual intrusions to the

settings or environmental context, unauthorized artifact collecting, and vandalism. In the cases of prehistoric, historic, and paleontological resources, Federal and State regulations regarding impacts are usually expressed in terms of the last ROI definition. Native American resources affected may also include viewsheds, plant communities, or resources such as mountains that are outside the potentially disturbed acreage, but may still be affected by a proposed alternative. Effects to Native American resources also include visual and audio intrusions to sacred sites and reduced access to traditional use areas. In this PEIS, each of these increasingly focused ROIs is addressed. For generic alternatives where a site is not specified, the ROI is described as a range of potentially affected resources.

Data used to assess the potentially affected cultural or paleontological resources at specific sites include information regarding the historic and prehistoric context of the proposed project area, its geology and paleontological potential, and the possible presence of sites, districts, or objects that may be eligible for listing on the National Register of Historic Places (NRHP) or may be significant to Native American groups. For non-site-specific alternatives, a general description of possible cultural or paleontological resources is presented.

Prehistoric Resources. The affected environment section for prehistoric resources includes a brief overview of the number and types of prehistoric sites in the ROI, if known, and their status on the NRHP. A summary of existing information about prehistoric resources in the ROI is provided, and the types of sites that are likely to occur are discussed.

Historic Resources. The affected environment section for historic resources includes a brief overview of the number and types of historic sites in the ROI, if known, and their status on the NRHP. The overview consists of a summary of existing information about historic resources in the ROI and a discussion of the types of sites that are likely to exist.

Native American Resources. The affected environment section for Native American resources includes a brief overview of the regional Native American groups whose resources may be affected, along with the number and types of sites, use areas, and other resources in the ROI, if known, and their status or significance. A summary of existing information about Native American resources in the ROI is provided, and the type of resources that are likely to exist is discussed.

Paleontological Resources. The affected environment section for paleontological resources includes a description of known paleontological localities and geological formations in the project areas that may be fossil-bearing.

3.1.8 SOCIOECONOMICS

Definition of Resources

Socioeconomics comprises the social, economic, and demographic characteristics of an area. The socioeconomic environment can be affected by changes in employment, income, and population, which, in turn, can affect area resources such as housing, community services, and infrastructure.

The socioeconomic analysis assesses the environmental consequences of demographic and economic changes resulting from proposed alternatives. The study focuses on the potential impacts of a change in the number of workers and their families on the economy, housing availability, community services, and infrastructure. This PEIS assesses health care, education, and public safety as representative indicators of community services. Local transportation is assessed as a representative indicator of community infrastructure. [Text deleted.]

Approach to Defining Environmental Setting

The socioeconomic environment is defined for two geographic regions: the regional economic area (REA) and the ROI. REAs are used to assess potential effects on the regional economy, and ROIs are used to assess effects that are more localized in political jurisdictions surrounding the sites.

The REA for each site encompasses a broad market that involves trade among and between regional industrial and service sectors and is characterized by strong economic linkages between the communities in the region. These linkages determine the nature and magnitude of multiplier effects of economic activity (purchases, earnings, and employment) at each site. REAs are defined by the U.S. Bureau of Economic Analysis (BEA) and consist of an economic node that serves as the center of economic activity and the surrounding counties that are economically related and include the places of work and residences of the labor force.

Potential demographic impacts were assessed for the ROI, a smaller geographic area where the housing market and local community services would be the most affected. Site-specific ROIs were identified as those counties where approximately 90 percent of the current DOE and contractor employees reside. This residential distribution reflects existing commuting patterns and attractiveness of area communities for people employed at each site and is used to estimate the future distribution of in-migrating workers. Impacts from technologies that would be located at an existing DOE site or that have sites identified as representative locations for analysis purposes were assessed using a site-specific ROI. Technology alternatives for which sites have not been identified, such as the deep borehole, were assessed using a more generic approach.

The most recent data available were used in the socioeconomic analyses. Data were obtained from sources such as the U.S. Bureau of the Census, the BEA, the Federal Bureau of Investigation, the American Medical Association, the American Hospital Association, State and local government publications, and telephone interviews with State and local government officials.

Socioeconomic issues and concerns focus primarily on how changes in the regional economy facilitated by construction and operation of a proposed alternative could affect the demographic composition and economic capacity of the host communities. Proposed alternatives could result in increased employment at potential sites, perhaps leading to population increases and associated changes in demand for community resources. The amount of change depends on the construction and operational requirements of the proposed alternatives and the socioeconomic capacity of the communities in the region where these alternatives may be sited.

New employment opportunities could be created in the regions where proposed alternatives would be located. Generally, the proposed alternatives would directly generate new income and jobs in construction, engineering, sciences, management, and support. Indirect income and job opportunities could also be created as a result of these new jobs to support new demand for goods and services generated from construction and operation

activities. These new jobs could be filled by existing available labor in the region, or workers could in-migrate from other areas to fill the jobs. The regions where proposed alternatives are located could benefit economically as a result of an increase in income, and the unemployment rate in the region could fall if new jobs are filled locally.

Increased income and employment opportunities are generally regarded as benefits to many communities. Local businesses gain additional customers, and local governments gain an increase in tax revenues. However, if the attraction of new jobs causes an influx of new workers and their families, this in-migration could overburden the housing market, community services, and infrastructure. Of concern is whether or not communities can absorb this new growth within existing systems or through expansion at a reasonable pace and cost.

The duration of the proposed alternative is an important issue. If the proposed alternative is a large construction effort of short duration with little or no operational employment following, there could be a boom-and-bust effect. Initially, there could be rapid economic expansion and increased demand for housing, community services, and infrastructure. Housing prices may rise, and services and infrastructure may have to be expanded or will become congested beyond capacity. After construction is complete and workers out-migrate to find work elsewhere, unemployment may rise, additional housing vacancies may occur, and expanded community services and infrastructure may be underutilized and more expensive to maintain. Some regions with sophisticated and varied economies can absorb rapid economic expansions and contractions without experiencing significant impacts, but for other communities the boom-and-bust effect could be devastating.

Local transportation discussions characterize the transportation systems in the ROI. The affected environment section describes the locations and general features of the ROI transportation networks, which include road, rail, air, and waterway systems. In addition, current and planned improvements to the road network that will affect access to the site are discussed, as well as public transportation to the site.

General information regarding local transportation modes in the ROI was obtained from local DOT and environmental documents. Roadways to be analyzed for traffic congestion were determined using current employee commuting patterns. Current levels of service designations for these roadways were calculated using information from the DOT, other socioeconomic analyses, and a transportation model designed from the *Highway Capacity Manual #209* equations and factors. This model is used to estimate future baseline No Action projections as well as level of service impacts associated with alternatives.

3.1.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

Definition of Resources

Public and occupational health and safety issues include the determination of potentially adverse effects on human health and safety that result from acute and chronic exposures to ionizing radiation and hazardous chemicals. The degree of hazard is directly related to the type and quantity of the particular radioactive or chemical material to which the person is exposed and to the duration of this exposure. For normal operations, the exposures have been converted to potential cancers and/or noncancer effects of an acute or a chronic nature. [Text deleted.]

Approach to Defining Environmental Setting

The current radiological and chemical environments at the various sites considered in this PEIS help characterize the setting and serve as a baseline against which impacts associated with the various alternative actions can be compared. Of particular importance are the radiological and hazardous chemical doses that workers and the public receive from exposures associated with both the natural background and existing site operations. These doses may result in health effects. To characterize each site's operational culture, an accident history is presented, past and ongoing health studies of people who work onsite or live in the vicinity are described, and the site's emergency management program is discussed.

Existing site environmental descriptions originate from a series of environmental and radioactive release reports issued annually by DOE sites or sites licensed by the NRC. These reports present the levels of radioactivity and hazardous chemicals in various environmental media (such as air, water, and vegetation) on the site, in the immediate vicinity of the site, and at various distances from the site boundary out to more than 100 km (62 mi). Radiological and chemical doses to individual members of the public and to population groups (including the total population within 80 km [50 mi] of the site) are also given in these reports. The main source of information used to establish existing health impacts to workers, both individual and collective, is the compilation of occupational exposures issued annually by DOE and NRC. Accident histories and the results of epidemiological studies were obtained from many literature sources, including incidence reports and medical journals.

Several methods were used to determine the environmental setting for generic sites. These included the use of regional or national average background radiological and chemical doses and concentrations, the assumption of radiological and chemical doses and concentrations that have been averaged over a number of representative sites; and the presentation of ranges of values associated with representative sites. For a generic borehole site, the current DOE sites proposed in the PEIS adequately bound normal operational radiological and chemical conditions in terms of population density and meteorological conditions; therefore, for the purposes of a generic analysis of the disposition technologies, ranges of conditions are presented. For a generic commercial reactor site, existing normal radiological impacts for representative commercial reactor sites and releases were determined, and a range of results is presented. For a generic commercial MOX fuel fabrication site, normal radiological impacts for representative commercial fuel fabrication sites and their releases were used to establish the range of conditions.

Toxic air pollutants are addressed in both the Air Quality and Noise section and the Public and Occupational Health and Safety section for each of the sites considered in this PEIS. In the air quality section, the maximum concentration of toxic air pollutants at or beyond the site boundary is compared with a Federal, State, or local standard to determine compliance. In the Public and Occupational Health and Safety section, a health risk is calculated based upon chemical concentration and toxicity compared to the RfC for the public and the PEL for workers for noncancer causing chemicals and slope factors for the public and workers for cancer causing chemicals. The cancer effects are a risk that is based on the slope factor (cancer potency) for chemicals that are regulated as carcinogens.

These differences in analytical method result in the different pollutants between the air quality analysis and the public and occupational health analysis. In the air quality analysis, toxic pollutants with low emission rates in most cases will result in extremely low concentrations at the site boundary and therefore are not presented in the air quality analysis. In the public and occupational health analysis, many of these same chemical pollutants may expose an onsite worker located 100 m (328 ft) from the emission source to a health risk and therefore are presented in this analysis. The hazardous chemical pollutants used by these two resource areas to evaluate impacts will be different. Compliance to standards in air quality does not consider what health effects are expected nor the interaction between several chemicals that may together cause health responses even if they separately are at below standard concentrations.

3.1.10 WASTE MANAGEMENT

Definition of Resources

Waste management includes minimization, characterization, treatment, storage, transportation, and disposal of waste generated from ongoing DOE activities. Waste management accepts waste produced by DOE's processing, manufacturing, remediation, D&D, and research activities. The waste is managed using appropriate treatment, storage, and disposal technologies and in compliance with all applicable Federal and State statutes and DOE orders. Appendix E defines the waste categories (high-level, TRU, low-level, mixed, hazardous, and nonhazardous) managed by DOE. Although spent nuclear fuel is not categorized with nuclear waste, it is included in the waste management section of this PEIS, since it is radioactive material that must be stored, managed, and handled. Wastes are generated and categorized by their health hazard and handling requirements. Treated waste is waste that, following generation, has been altered chemically or physically to reduce its toxicity or to prepare it for storage or disposal. Waste treatment can include volume reduction activities, such as incineration or compaction, which may be performed on waste before storage, disposal, or both. Stored waste is waste that, following generation (and usually some treatment), is being retained (temporarily) in a retrievable manner and monitored pending disposal. Disposed waste is waste that has been put in final emplacement to ensure its isolation from the environment and with no intention of retrieval. Deliberate action would be required to regain access to the waste. Disposed wastes include materials placed in a geological repository and buried in landfills.

Approach to Defining Environmental Setting

In order to operate most of its facilities, DOE has entered into numerous agreements with States and EPA to address compliance issues concerning certain aspects of environmental regulatory requirements that have arisen due to either the age of DOE facilities or the uniqueness of DOE operations. For the most part, DOE facilities are in compliance with a major portion of all environmental regulatory requirements, and these compliance agreements address a few specific situations. Appendix E summarizes the applicable Federal statutes and DOE Orders relevant to waste management. In the siting and construction of new facilities, the intent is to meet current regulations; to reach the goal of maximum recycle, minimum waste generation, and no liquid discharges to the surface; and to treat and stabilize unavoidable wastes sufficiently for storage (greater than 90 days) or permanent disposal either onsite or offsite.

Both DOE and the sites maintain waste management databases and publish documents as a reporting mechanism to disclose and gauge progress in meeting environmental regulatory requirements. These databases and reports represent key sources of data that were used for analysis for the waste management resource area. Specific examples include the Waste Management Information System database; the *Integrated Database for U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics Report*; and the *Mixed Waste Inventory Report*. Other site-specific documents include Annual Waste Minimization and Generation Reports, Site Treatment Plans, Pollution Prevention and Waste Minimization Awareness Plans, Annual Environmental Reports, and Waste Management Plans.

For the generic borehole site, a pristine condition was assumed. For example, no waste generation activities or waste management facilities exist. The generic fuel fabrication facility was compiled from characteristics based on several existing commercial fuel fabricator facilities.

Site-specific data from existing representative LWRs were used to develop a generic existing LWR site. For the generic partially completed reactor, an approach similar to that used for the generic existing LWR site was taken. However, because completion of construction has been deferred, maintenance and limited engineering design work are the only activities. Therefore, only a description of waste management practices that would go into effect once the reactors are operational is provided.